

A FLORISTIC SURVEY OF THE FORESTED PARTS OF
THE UNITED PLANT SAVERS' ETHNOBOTANICAL
SANCTUARY, MEIGS COUNTY, OHIO

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ABSTRACT. The United Plant Savers' (UpS) botanical sanctuary in southeastern Ohio was created to protect native medicinal plants by protecting their habitat. Located in the southern unglaciated Allegheny Plateau physiographic province, this 155 ha preserve is 70% (110 ha) deciduous forest, 30% (45 ha) old fields, and contains one small opening that was surveyed to determine whether it was a remnant prairie. A floristic survey of the vascular plants of the wooded portions of the sanctuary and the opening revealed 358 species in 238 genera and 97 families. This total includes two state-listed, "potentially threatened" species: *Corallorhiza wisteriana* and *Juglans cinerea*. Nine percent of the species identified are non-native to southeastern Ohio. The vegetation found in the opening does not indicate that it is actually a prairie.

Key Words: vascular flora, Ohio, botanical sanctuary, conservation, medicinal plants, United Plant Savers

The United Plant Savers (UpS), a non-profit organization working in the United States and Canada, promotes the conservation of native medicinal plants and their habitat through education and land preservation. Their land preservation effort is primarily carried out through a botanical sanctuary network in which UpS members can designate private land for in-situ conservation of medicinal plants. Their education programs focus on community workshops and summer internships. In Meigs County, Ohio, the UpS established their largest sanctuary, a 155 ha preserve of forest and field, in 1999.

Study site. The Meigs County sanctuary (39°5'N, 82°9'W, Rutland Quadrangle; United States Geological Survey 1995) is in southeastern Ohio, approximately 20 miles south of Athens (Figure 1). The sanctuary is located in southwestern Meigs County, in Rutland Township. Covering 155 ha, it is composed of 70% secondary forest and 30% old fields. There is also one small opening located on a hilltop in the southwestern portion

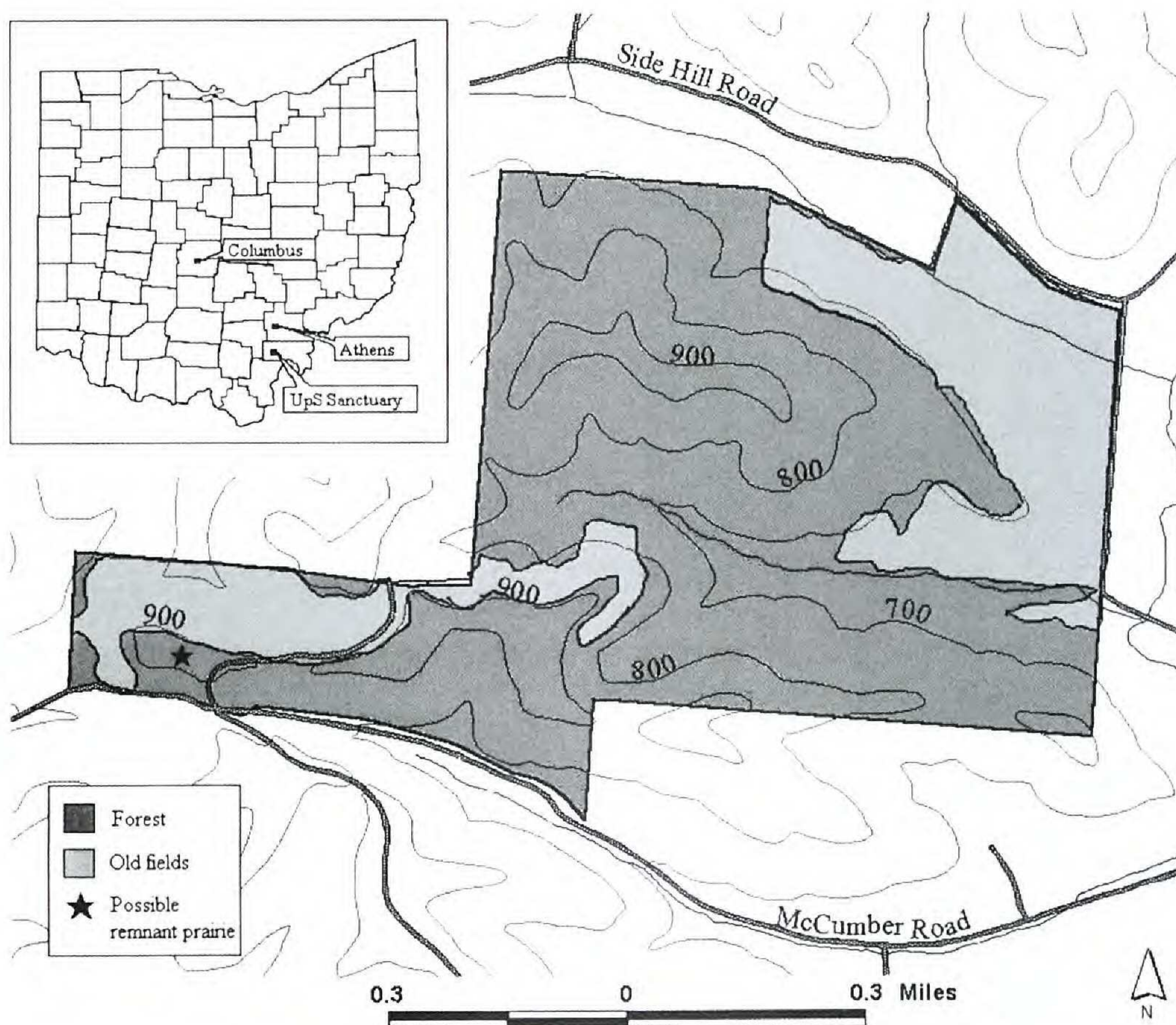


Figure 1. Location of the United Plant Savers' sanctuary in Meigs County, Ohio. Sanctuary land is outlined in black. The dark shaded regions represent the forested portions of the sanctuary. The light shaded regions represent the old fields, including the one converted to the planted prairie, that were not surveyed in this study.

of the sanctuary, which was considered a possible remnant prairie. This opening plus the wooded portion constitute about 110 ha of the sanctuary.

Climate. Climate in southeastern Ohio is temperate, with hot summers and cold winters. Precipitation falls year round. Temperature and precipitation data for Carpenter, Ohio (39°9'N, 82°17'W) are provided in Table 1. Mean annual snowfall in Meigs County is 53.3 cm (Gilmore and Bottrell 1999).

Physiography and geology. Meigs County is part of the southern unglaciated Allegheny Plateau, which makes up a portion of the larger Appalachian Plateau physiographic province (Braun 1961). This high-relief area is composed of narrow ridgetops (which run primarily in an east-west direction), hills, and stream valleys (Gilmore and Bottrell 1999). Within the sanctuary, elevation ranges from 190 to 280 meters

Table 1. Temperature and precipitation data collected from Carpenter, Ohio in Meigs County (National Climatic Data Center and National Oceanic and Atmospheric Association 2001).

	Annual	Minimum (Month)	Maximum (Month)
Mean temperature (°C)	11.3	−1.6 (Jan)	22.8 (Jul)
Mean temperature 2000 (°C)	11.1	−4.8 (Dec)	21.3 (Aug)
Mean temperature 2001 (°C)	11.8	−1.7 (Jan)	23.1 (Aug)
Mean precipitation (cm)	104.33	6.49 (Oct)	11.27 (May)
Precipitation 2000 (cm)	90.65	2.11 (Oct)	16.10 (Feb)
Precipitation 2001 (cm)	93.27	3.96 (Sep)	18.52 (May)

(United States Geological Survey 1995). The bedrock underlying the sanctuary is sandstone and shale from the Monongahela and Conemaugh groups of the Pennsylvanian system with outcroppings from the Ames limestone interval (Schumacher 1995).

Soils. The majority of the soils on slopes and ridgetops in the sanctuary are Alfisols and Ultisols, specifically Upshur (fine, mixed, mesic Typic Hapludalfs) – Gilphin (fine-loamy, mixed, mesic Typic Hapludults) complexes (Gilmore and Bottrell 1999). On slopes, these are deep to moderately deep, well-drained soils with a silt loam surface layer. The Upshur subsoil is silty clay loam and silty clay, and the Gilphin subsoil is channery loam, very channery loam, and silt loam. On ridgetops the soils are deep to very deep and well-drained. The surface silt-loam layer has been partially eroded. The Upshur subsoil is silty clay loam and silty clay, and the Gilphin subsoil is silt loam and silty clay loam. Soils in areas that have been strip-mined in the past are Entisols. These are very deep, excessively well-drained, Pinegrove (mixed, mesic Typic Udipsamments) coarse sand loams. Intermittent stream bottoms have Inceptisols from the Chagrin (fine-loamy, mixed, mesic Dystric Fluventic Eutrochrepts) series. These soils are very deep, well-drained silt loams that are frequently flooded (Gilmore and Bottrell 1999).

Vegetation. Delcourt and Delcourt (1988) described this region as eastern deciduous forest. This forest type has characteristic multistoried vegetation, a diverse understory, and a rich flora of spring ephemerals. Within the preserve, the ridges and upper slopes support oak-hickory forest, whereas mixed mesophytic forest predominates on lower slopes and stream terraces. Mixed mesophytic forest (Braun 1950) is a general term describing deciduous forest with multiple canopy codominants, including *Acer saccharum*, *Aesculus flava*, *Fagus grandifolia*,

Liriodendron tulipifera, *Quercus alba*, *Q. rubra*, *Tilia americana*, and formerly *Castanea dentata*.

Land use. The major industry in Meigs County, both in the past and today, has been agriculture. Other natural resource industries present in the county are the extraction of coal, oil, gas, timber, sand, and gravel (Gilmore and Bottrell 1999). Historically, the sanctuary land has been farmed, grazed, logged, and strip-mined for coal (Zanski 1997). There are several old fields in the sanctuary that mark past agricultural use and were not included in this study. Other areas on the sanctuary represent past strip-mining operations. These areas are now characterized by open fields at the base of steep, sandstone rock walls that were created by the mining process.

Since the early 1970s, natural vegetation on what is now the sanctuary has been regenerating. Current restoration and reconstruction efforts in the UpS sanctuary have centered on two ecosystem types—forest and prairie. Within the forest, there has been mostly natural regeneration. Only two species that were not found there previously, *Cypripedium parviflorum* and *Chamaelirium luteum*, have been purposely introduced. Additionally, *Panax quinquefolius*, *Hydrastis canadensis*, and *Cimicifuga racemosa* populations, which were already present when the preserve was created, have been expanded by spreading seed within the forest (Paul Strauss, UpS, pers. comm.). The conversion of an old field to a planted prairie has involved more habitat manipulation with the introduction of species that are native to western Ohio prairies. There is, though, one opening (the possible remnant prairie) that has not been intentionally altered by the preserve managers (Paul Strauss, UpS, pers. comm.). Although much of the land in Meigs County is used for farming or natural resource extraction, the sanctuary is surrounded by 1700 acres of private, mostly forested land managed with a similar conservation philosophy.

Objectives. The flora of the UpS sanctuary has never been systematically recorded. This study provides baseline data on the vascular flora of the wooded portion of the sanctuary and the possible remnant prairie, in order to facilitate future research on the sustainability and population ecology of medicinal plants.

MATERIALS AND METHODS

The vascular flora was surveyed on the UpS land from May through October 2000 and from March through October 2001. During both

Table 2. Description of abundance ratings as developed by Palmer et al. (1995).

Density	Score	Description
Abundant	5	Dominant or codominant in one or more common habitats
Frequent	4	Easily found in one or more common habitats but not dominant in any common habitat
Occasional	3	Widely scattered but not difficult to find
Infrequent	2	Difficult to find with few individuals or colonies, but found in several locations
Rare	1	Very difficult to find, limited to one or very few locations/uncommon habitats

years, biweekly trips were made to the sanctuary. Random paths were walked through the 110 ha study area in order to cover it as thoroughly as possible. All forested areas, forest edges, and the possible remnant prairie site were surveyed. The planted prairie and the fields were excluded from the study. Two voucher specimens were made for each species: one for the Bartley Herbarium at Ohio University (BHO) and one for the UpS collection.

To organize the floristic survey, the study area was divided into units following topographic boundaries. These included ridgetops, slopes, and stream terraces. Each unit was surveyed several times during the year to document the flora. For each species found, general habitat was noted (i.e., whether it occurred along the stream terraces, on the slopes, on ridgetops, in the possible remnant prairie, or in some combination of these areas). Additionally, an abundance score from one to five was determined for each species based on a scale developed by Palmer et al. (1995; Table 2). For this study, a score of 5 was used only for woody species, whereas all other scores were used for both woody and herbaceous species.

Species were identified using Braun (1961, 1967), Cooperrider (1995), Fisher (1988), Gleason and Cronquist (1991), and Holmgren (1998). Nomenclature, family classification, and native/non-native species status follow Cooperrider et al. (2001), with the following exceptions. *Phryma* is assigned to Phrymaceae rather than Verbenaceae, based on recent molecular evidence that it is not closely related to Verbenaceae (Beardsley and Olmstead 2002). Retaining a broader

Table 3. Number of taxa found in forested portions and possible remnant prairie of United Plant Savers' sanctuary, Meigs County, Ohio.

Division	Families	Genera	Species		Total
			Native	Non-native	
Lycopodiophyta	1	1	1	0	1
Polypodiophyta	7	14	19	0	19
Pinophyta	2	2	2	0	2
Magnoliophyta	87	221	303	33	336
TOTAL	97	238	325	33	358

circumscription of *Eupatorium* (Gleason and Cronquist 1991), *E. rugosum* is not treated as *Ageratina*, as in Cooperrider et al. (2001).

RESULTS

A total of 358 species in 238 genera, 97 families, and four divisions of vascular plants were identified from the forest and possible remnant prairie combined (Table 3; Appendix). Approximately 9% (33) of the species in the total flora were not native to southeastern Ohio. Within the wooded portions of the sanctuary, 331 species were identified, about 8% (26) of which were non-native (Table 4). In the possible remnant prairie, there were 84 species identified, about 15% (13) of which were non-native (Appendix).

For the entire flora, the families with the most species were Asteraceae (37 species), Poaceae (24), Lamiaceae (18), Rosaceae (18), Cyperaceae (16), and Fabaceae (15). Genera with the most species were *Carex* (14 species), *Aster* (7), *Desmodium* (7), *Galium* (5), *Hypericum* (5), *Polygonum* (5), and *Solidago* (5). Thirty-three species in 20 families were non-native to southeastern Ohio. The families with the most non-native species were Asteraceae (4 species), Poaceae (4), Brassicaceae (3), and Fabaceae (3).

Of the 33 non-native species, 16 were found solely in forest edge habitats or the possible remnant prairie. Of these 16, *Ailanthus altissima* and *Melilotus officinalis* are listed among the most invasive plants in Ohio, and *Daucus carota* is listed as a well-established non-native species [Ohio Department of Natural Areas and Preserves (ODNAP) 2000] and as a noxious weed (Rose and Sheaffer 1998). Of the 17 non-native species found in the interior of the forest, three are considered among Ohio's most invasive plants (*Elaeagnus umbellata*, *Lonicera japonica*, and *Rosa multiflora*). Additionally, *Berberis thunbergii* is listed as a well-established non-native species (ODNAP 2000), and

Table 4. Floristic data from regional and smaller-scale floras of the unglaciated Appalachian Plateau: unglaciated Ohio (Cusick and Silberhorn 1977), The Ridges (Kline 1994), Dysart Woods (Johnson 2001), and Lilley Cornett Woods (Sole et al. 1983). All smaller-scale floras represent forest only. The size of unglaciated Ohio is an estimated value.

	Size (ha)	Number of		Percent Non-native Species
		Species	Families	
United Plant Savers, Ohio (total)	110	358	97	9
Unglaciated Ohio	3,200,000	2029	141	24
United Plant Savers, Ohio (forest)	110	331	95	8
The Ridges, Ohio	95	295	94	17
Dysart Woods, Ohio	35	233	69	18
Lilley Cornett Woods, Kentucky	105	304	78	–

Chrysanthemum leucanthemum is included in the state noxious weed list (Rose and Sheaffer 1998). It is noteworthy that several species that are invasive in southern Ohio forests were not found at the sanctuary (including *Alliaria petiolata*, *Celastrus orbiculatus*, *Euonymus alatus*, *E. fortunei*, *Ligustrum vulgare*, and *Lonicera maackii*).

Two species from the flora are state-listed as “potentially threatened:” *Juglans cinerea* and *Corallorhiza wisteriana* (ODNAP 2002). Five species are considered characteristic of southeastern Ohio (Cusick and Silberhorn 1977). These species are typical of the southern Appalachians, and in Ohio they reach the northern limit of their range on the southern Allegheny Plateau. They are *Aesculus flava*, *Elephantopus carolinianus*, *Oxydendrum arboreum*, *Salvia lyrata*, and *Scutellaria serrata*.

DISCUSSION

Comparison with other floras. The total UpS sanctuary flora (forest and possible remnant prairie) was compared with the regional flora of unglaciated Ohio, and the forest flora of the UpS was compared with several smaller-scale forest floras (Table 4). As of 1977 (Cusick and Silberhorn), the unglaciated region of Ohio, covering all or part of 33 counties, had 141 recorded families, 701 genera, and 2029 species. The total UpS sanctuary flora represents about 69% of the families, 34% of the genera, and 18% of the species of the region. In unglaciated Ohio, as in the UpS sanctuary, Asteraceae, Poaceae, Cyperaceae, Rosaceae, Fabaceae, and Lamiaceae were the most species-rich families, but the Cyperaceae and Fabaceae were more species-rich in the regional flora. In both floras, *Carex* was the most species-rich genus. However, the

genera *Crataegus*, *Viola*, and *Panicum* included many species regionally that were lacking at the UpS sanctuary.

Two local Ohio floras and one from southeastern Kentucky were used for smaller-scale comparisons: “The Ridges” in Athens County, Ohio (Kline 1994); Dysart Woods Laboratory in Belmont County, Ohio (Johnson 2001); and Lilley Cornett Woods in Letcher County, Kentucky (Sole et al. 1983). From each of these floras, only the forested areas were used for comparison. Therefore, if the flora contained species from old fields or other open areas, they were omitted. Similarly, the possible remnant prairie was omitted from the UpS sanctuary flora.

In comparison to similarly sized parcels, the forests of UpS were slightly more species-rich than “The Ridges” and Lilley Cornett Woods and most similar in family richness to “The Ridges” (Table 4). Dysart Woods Laboratory had fewer species and families but was also much smaller in size. The percentage of non-native plants at the UpS sanctuary, 8%, was comparatively low. All of the smaller-scale floras had a lower percentage of non-native species than the regional flora, presumably due to the fact that they did not include fields, roadsides, and other highly disturbed areas.

The rankings of families based on species richness were similar in all of these floras except that Lilley Cornett Woods had more Ericaceae than the Ohio floras, mostly due to the presence of several *Rhododendron* species that are not found in southeastern Ohio.

Possible remnant prairie. The presence of remnant prairies within the deciduous forests of Ohio is limited, and most are located in the central and western parts of the state (Transeau 1935). This does not mean that prairie habitat cannot be found in southeastern Ohio. Wistendahl (1975) described a remnant prairie, Buffalo Beats, in the northern part of Athens County based on the presence of several prairie species that are otherwise uncommon in the county.

When comparing the species of the possible remnant prairie to those found by Wistendahl (1975), there was only one species in common, *Amphicarpaea bracteata*. This species was common in most sanctuary habitats, so presence in this part of the sanctuary was not indicative of an unusual plant community. Furthermore, the UpS “prairie” did not have any of the typical, dominant grass species of mesic prairie habitats, such as *Andropogon gerardii*, *Sorghastrum nutans*, and *Panicum virgatum* (Weaver and Fitzpatrick 1934). Only a few species found in the possible prairie remnant (*Asclepias tuberosa*, *A. hirtella*, *Panicum lanuginosum*, *Pycnanthemum tenuifolium*, and *Rosa carolina*) were noted by Gleason

and Cronquist (1991) as being found in prairie habitats. Of these species, all but *A. hirtella* were also listed as occurring in habitats other than prairie.

Most of the species present in the possible prairie remnant in 2000–2001 were more characteristic of a disturbed area than prairie habitat. The percent of non-native species (15%) was almost twice as high as in the forested portions (8%). *Elaeagnus umbellata*, which was the dominant shrub, is an invasive species that was commonly planted on strip-mine spoils for erosion control and wildlife habitat (ODNAP 2000). Although the hilltop where the possible prairie remnant is located was not itself mined, much of the surrounding area was. If this part of the sanctuary ever supported prairie species they have now been eliminated. The current vegetation does not provide convincing evidence that it was once a prairie.

State-listed species. Both of the state-listed “potentially threatened” species were rare in the sanctuary. Only one population of *Corallorhiza wisteriana* was located, with approximately 40 individuals. This population was found on a high-elevation ridgetop, away from forest paths and regular human disturbance. The stand of *Juglans cinerea*, located on the forest edge, consisted of only a few individuals. The main threat to this species is from a canker fungus (Schneider 1993).

The UpS sanctuary network is unique in its focus on protecting habitat for native medicinal plants. At the sanctuary in Meigs County, Ohio, researchers study the population ecology and sustainability of the medicinal plant species. Educational workshops at this UpS sanctuary allow researchers and conservationists to share their work. This study has provided the first formal survey of the forests of the sanctuary. Based on comparisons of this flora with the regional flora and with other local floras of similar-sized areas, the flora of the sanctuary is typical of the region. The vegetation of the possible prairie remnant is more indicative of a disturbed area than a native prairie. The results of this study can be used as baseline data for future research at the sanctuary.

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APPENDIX

SPECIES DOCUMENTED AT THE UNITED PLANT SAVERS' SANCTUARY,
MEIGS COUNTY, OHIO

The list is arranged alphabetically within divisions. Taxonomy and nomenclature follow Cooperrider et al. (2001) unless indicated with a dagger (†). Species preceded by an asterisk (*) are not native to southeastern Ohio (Cooperrider et al. 2001). Species preceded by a double asterisk (**) are native to southeastern Ohio, but the populations at the United Plant Savers' sanctuary are introduced. Species preceded by a PT are listed as potentially threatened within the state of Ohio (ODNAP 2002). The habitat of a species is indicated as follows: ridge top (R), slope (S), stream terrace (T), solely forest edge (E), solely on paths in the forest (Path), and possible remnant prairie (P). Collection numbers are those of the first author. Voucher specimens are deposited at the Bartley Herbarium at Ohio University (BHO).

LYCOPODIOPHYTA

LYCOPODIACEAE. *Diphasiastrum digitatum* (Dill. ex A. Braun) Holub – Infrequent; T, S, R; 142.

POLYPODIOPHYTA

ADIANTACEAE. *Adiantum pedatum* L. – Infrequent; T; 479.

ASPLENIACEAE. *Asplenium platyneuron* (L.) Britton, Sterns & Poggenb. – Occasional; T, S, R, P; 108. *Asplenium rhizophyllum* L. – Rare; T; 162.

DENNSTAEDTIACEAE. *Dennstaedtia punctilobula* (Michx.) T. Moore – Rare; S; 645.

DRYOPTERIDACEAE. *Athyrium filix-femina* (L.) Roth ex Mert. – Rare; S; 701. *Cystopteris protrusa* (Weath.) Blasdell – Rare; S; 650. *Deparia acrostichoides* (Sw.) M. Kato – Occasional; T; 248. *Diplazium pycnocarpon* (Spreng.) M. Broun – Rare;

T; 273. *Dryopteris carthusiana* (Vill.) H. P. Fuchs – Frequent; T, S, R; 51. *Dryopteris goldiana* (Hook. ex Goldie) A. Gray – Infrequent; T, S; 250. *Dryopteris intermedia* (Muhl. ex Willd.) A. Gray – Infrequent; S; 259. *Dryopteris marginalis* (L.) A. Gray – Rare; T; 394. *Onoclea sensibilis* L. – Occasional; T, S; 580. *Polystichum acrostichoides* (Michx.) Schott – Frequent; T, S, R, P; 52.

OPHIOGLOSSACEAE. *Botrychium dissectum* Spreng. – Infrequent; S; 700. *Botrychium virginianum* (L.) Sw. – Occasional; T, S; 575.

POLYPODIACEAE. *Polypodium virginianum* L. – Infrequent; T; 237.

THELYPTERIDACEAE. *Phegopteris hexagonoptera* (Michx.) Fée – Occasional; T, S; 413. *Thelypteris noveboracensis* (L.) Nieuwl. – Occasional; T, S; 396.

PINOPHYTA

CUPRESSACEAE. *Juniperus virginiana* L. – Infrequent; R, P; 328.

PINACEAE. *Pinus virginiana* Mill. – Infrequent; R, P; 362.

MAGNOLIOPHYTA

ACANTHACEAE. *Ruellia strepens* L. – Rare; S; 638.

ACERACEAE. *Acer rubrum* L. – Frequent; T, S, R; 19. *Acer saccharum* Marshall – Abundant; T, S, R; 11.

ANACARDIACEAE. *Rhus copallina* L. – Rare; P; 332. *Rhus glabra* L. – Infrequent; E; 292. *Rhus typhina* L. – Infrequent; E; 671. *Toxicodendron radicans* (L.) Kuntze – Occasional; T, S, R, P; no voucher.

ANNONACEAE. *Asimina triloba* (L.) Dunal – Frequent; T, S, R; 23.

APIACEAE. *Cryptotaenia canadensis* (L.) DC. – Occasional; T, S; 87. **Daucus carota* L. – Infrequent; P; 656. *Erigenia bulbosa* (Michx.) Nutt. – Occasional; T; 501. *Osmorhiza claytonii* (Michx.) C. B. Clarke – Occasional; T, S; 244. *Osmorhiza longistylis* (Torr.) DC. – Occasional; T, S; 583. *Sanicula canadensis* L. – Frequent; T, S, R; 245. *Sanicula gregaria* E. P. Bicknell – Occasional; T, S; 46. *Sanicula trifoliata* E. P. Bicknell – Occasional; T, S; 266.

APOCYNACEAE. *Apocynum cannabinum* L. – Rare; P; 134.

ARACEAE. *Arisaema dracontium* (L.) Schott – Rare; T; no voucher. *Arisaema triphyllum* (L.) Schott – Occasional; T, S; 561.

ARALIACEAE. *Aralia racemosa* L. – Rare; S; 390. *Panax quinquefolius* L. – Occasional; T, S; 706.

ARISTOLOCHIACEAE. *Aristolochia serpentaria* L. – Infrequent; S; no voucher. *Asarum canadense* L. – Frequent; T, S; 537.

ASCLEPIADACEAE. *Asclepias hirtella* (Pennell) Woodson – Rare; R, P; 255. *Asclepias quadrifolia* Jacq. – Rare; S; 599. *Asclepias tuberosa* L. – Rare; P; 635.

ASTERACEAE. *Achillea millefolium* L. – Rare; P; 130. *Ambrosia artemisiifolia* L. – Infrequent; S, R, P; 462. *Antennaria plantaginifolia* (L.) Richardson – Infrequent; S, R; 546. *Aster cordifolius* L. – Occasional; S; 451. *Aster divaricatus* L. – Occasional; T, S; 347. *Aster lanceolatus* Willd. – Infrequent; S; 448. *Aster lateriflorus* (L.) Britton – Infrequent; S; 421. *Aster pilosus* Willd. – Rare; P; 713. *Aster prenanthoides* Muhl. ex Willd. – Occasional; S; 426. *Aster shortii* Lindl. – Occasional; S; 440. *Bidens frondosa* L. – Occasional; T, S; 449. **Chrysanthemum leucanthemum* L. – Occasional; R, P; 126. **Cichorium intybus* L. – Rare; E; 699. *Cirsium discolor* (Muhl. ex Willd.) Spreng. – Rare; E; 366. *Elephantopus carolinianus* Raeusch. – Infrequent; S, P; 365. *Erigeron annuus* (L.) Pers. – Rare; S, P; 205. *Erigeron philadelphicus* L. – Infrequent; S; 27. *Erigeron strigosus* Muhl. ex Willd. – Infrequent; P; 206. *Eupatorium coelestinum* L. – Infrequent; S; 404. *Eupatorium fistulosum* Barratt – Infrequent; E; 690. *Eupatorium purpureum* L. – Infrequent; E; 692. †*Eupatorium rugosum* Houtt. – Frequent; T, S, R, P; 220. *Euthamia graminifolia* (L.) Nutt. – Rare; R; 693. *Helianthus divaricatus* L. – Infrequent; S; 240. **Hieracium caespitosum* Dumort. – Rare; P; 612. *Hieracium scabrum* Michx. – Infrequent; E; 687. *Hieracium venosum* L. – Infrequent; R; 38. *Rudbeckia hirta* L. – Rare; E; 683. *Senecio aureus* L. – Infrequent; E; 31. *Solidago caesia* L. – Occasional; T, S; 436. *Solidago flexicaulis* L. – Occasional; T; 453. *Solidago juncea* Aiton – Occasional; R, P; 207. *Solidago nemoralis* Aiton – Occasional; S, P; 360. *Solidago ulmifolia* Muhl. ex Willd. – Occasional; S; 341. **Taraxacum officinale* Weber ex F. H. Wigg. – Rare; S; 551. *Verbesina alternifolia* (L.) Britton ex Kearney – Infrequent; S; 313. *Vernonia gigantea* (Walter) Trel. ex Branner & Coville – Infrequent; E; 406.

BALSAMINACEAE. *Impatiens capensis* Meerb. – Frequent; T, S, R; 160. *Impatiens pallida* Nutt. – Occasional; T, S; 156.

BERBERIDACEAE. **Berberis thunbergii* DC. – Infrequent; S; 544. *Caulophyllum thalictroides* (L.) Michx. – Frequent; T, S; 516. *Jeffersonia diphylla* (L.) Pers. – Occasional; T, S; 80. *Podophyllum peltatum* L. – Frequent; T, S, R, P; 572.

BETULACEAE. *Carpinus caroliniana* Walter – Occasional; T, S, R; 276. *Ostrya virginiana* (Mill.) K. Koch – Frequent; T, S, R; 309.

BIGNONIACEAE. *Campsis radicans* (L.) Seem. ex Bureau – Rare; E; 672.

BORAGINACEAE. *Cynoglossum virginianum* L. – Occasional; S, R; 576. *Hackelia virginiana* (L.) I. M. Johnst. – Infrequent; T; 213. *Myosotis macrosperma* Engelm. – Infrequent; T, S, R; 568.

BRASSICACEAE. **Barbarea vulgaris* R. Br. – Infrequent; E; 18. *Cardamine concatenata* (Michx.) Sw. – Frequent; T, S, R; 506. *Cardamine douglassii* Britton – Occasional; T, S; 500. **Cardamine hirsuta* L. – Infrequent; T, S; 4. *Cardamine*

pensylvanica Muhl. ex Willd. – Rare; T; 579. **Lepidium campestre* (L.) R. Br. – Rare; P; 132.

CAESALPINIACEAE. *Cercis canadensis* L. – Infrequent; T, S, R, P; 17. *Gleditsia triacanthos* L. – Infrequent; S; 684.

CAMPANULACEAE. *Campanula americana* L. – Infrequent; T, S; 193. *Lobelia inflata* L. – Occasional; T, S, R, P; 224. *Lobelia siphilitica* L. – Rare; Path; 422.

CAPRIFOLIACEAE. **Lonicera japonica* Thunb. – Infrequent; S, R, P; 53. *Sambucus canadensis* L. – Infrequent; E; 54. *Triosteum angustifolium* L. – Occasional; T, S; 275. *Viburnum acerifolium* L. – Occasional; T, S, R; 41. *Viburnum prunifolium* L. – Occasional; S; 446.

CARYOPHYLLACEAE. **Dianthus armeria* L. – Infrequent; S, R, P; 136. *Paronychia canadensis* (L.) Alph. Wood – Occasional; S; 191. *Silene virginica* L. – Infrequent; S, R; 25. **Stellaria media* (L.) Vill. – Infrequent; S, R; 5.

CELASTRACEAE. *Celastrus scandens* L. – Rare; S; 428.

CLUSIACEAE. *Hypericum drummondii* (Grev. & Hook.) Torr. & A. Gray – Rare; R; 694. *Hypericum mutilum* L. – Infrequent; Path; 308. **Hypericum perforatum* L. – Infrequent; P; 644. *Hypericum prolificum* L. – Rare; P; 214. *Hypericum punctatum* Lam. – Occasional; S, R, P; 209.

COMMELINACEAE. **Commelina communis* L. – Rare; S; 288. *Tradescantia virginiana* L. – Infrequent; R; 40.

CONVOLVULACEAE. *Calystegia spithamea* (L.) Pursh – Rare; P; 615. *Ipomoea pandurata* (L.) G. Mey. – Infrequent; S, P; 222.

CORNACEAE. *Cornus alternifolia* L. f. – Rare; T; 704. *Cornus florida* L. – Infrequent; T, S, R; 7. *Nyssa sylvatica* Marshall – Infrequent; T, S; 655.

CRASSULACEAE. *Sedum ternatum* Michx. – Occasional; T, S; 21.

CYPERACEAE. *Carex albicans* Willd. ex Spreng. – Rare; T, S; 513. *Carex albursina* E. Sheld. – Occasional; T, S, R; 563. *Carex blanda* Dewey – Occasional; S; 16. *Carex careyana* Torr. ex Dewey – Occasional; T, S; 532. *Carex cephalophora* Muhl. ex Willd. – Occasional; P; 122. *Carex frankii* Kunth – Rare; T, S; 152. *Carex hirsutella* Mack. – Occasional; R, P; 48. *Carex jamesii* Schwein. – Infrequent; S; 83. *Carex laxiflora* Lam. – Infrequent; T, S; 540. *Carex pensylvanica* Lam. – Occasional; R; 36. *Carex rosea* Schkuhr ex Willd. – Occasional; T, R, S; 592. *Carex sparganioides* Muhl. ex Willd. – Rare; S; 616. *Carex vulpinoidea* Michx. – Infrequent; S; 146. *Carex woodii* Dewey – Infrequent; R; 565. *Scirpus cyperinus* (L.) Kunth – Infrequent; S; 233. *Scirpus polyphyllus* Vahl – Rare; S; 144.

DIOSCOREACEAE. *Dioscorea villosa* L. – Occasional; S; 678.

EBENACEAE. *Diospyros virginiana* L. – Rare; P; 474.

ELAEAGNACEAE. **Elaeagnus umbellata* Thunb. – Occasional; S, R, P; 32.

ERICACEAE. *Oxydendrum arboreum* (L.) DC. – Occasional; S, R; 336. *Vaccinium pallidum* Aiton – Rare; R; 34. *Vaccinium stamineum* L. – Occasional; R; 37.

EUPHORBIACEAE. *Acalypha virginica* L. – Infrequent; S, R; 264.

FABACEAE. *Amphicarpaea bracteata* (L.) Fernald – Occasional; T, S, R, P; 703. *Desmodium ciliare* (Muhl. ex Willd.) DC. – Rare; P; 358. *Desmodium nudiflorum* (L.) DC. – Occasional; T, S, R, P; 230. *Desmodium paniculatum* (L.) DC. – Occasional; T, S, R; 298. *Desmodium pauciflorum* (Nutt.) DC. – Rare; T, S; 247. *Desmodium rotundifolium* DC. – Rare; R; 326. *Desmodium viridiflorum* (L.) DC. – Infrequent; S; 282. *Desmodium* sp. – Infrequent; T; 399. *Lespedeza hirta* (L.) Hornem. – Rare; S; 343. *Lespedeza intermedia* (S. Watson) Britton – Rare; P; 356. **Melilotus officinalis* (L.) Pall. – Rare; E; 624. *Robinia pseudoacacia* L. – Occasional; S; 588. **Trifolium campestre* Schreb. – Infrequent; P; 138. **Trifolium repens* L. – Infrequent; E; 657. *Vicia caroliniana* Walter – Rare; R; 555.

FAGACEAE. **Castanea mollissima* Blume – Rare; E; 629 [Planted; Paul Strauss, UpS, pers. comm.]. *Fagus grandifolia* Ehrh. – Frequent; T, S, R; 386. *Quercus alba* L. – Abundant; T, S, R, P; 470. *Quercus prinus* L. – Frequent; T, S, R; 384. *Quercus rubra* L. – Abundant; T, S, R, P; 189. *Quercus velutina* Lam. – Abundant; T, S, R, P; 290.

FUMARIACEAE. *Corydalis flavula* (Raf.) DC. – Rare; S; 526. *Dicentra canadensis* (Goldie) Walp. – Rare; S; 535. *Dicentra cucullaria* (L.) Bernh. – Occasional; T, S; 517.

GENTIANACEAE. *Obolaria virginica* L. – Rare; R; 570. *Sabatia angularis* (L.) Pursh – Rare; P; 696.

GERANIACEAE. **Geranium columbinum* L. – Rare; E; 223. *Geranium maculatum* L. – Occasional; T, S, R; 19.

HIPPOCASTANACEAE. *Aesculus flava* Aiton – Frequent; T, S; 411.

HYDRANGEACEAE. *Hydrangea arborescens* L. – Occasional; T; 150.

HYDROPHYLLACEAE. *Hydrophyllum macrophyllum* Nutt. – Occasional; T, S; 58. *Hydrophyllum virginianum* L. – Occasional; S; 91.

IRIDACEAE. *Sisyrinchium angustifolium* Mill. – Infrequent; T, S; 195.

JUGLANDACEAE. *Carya cordiformis* (Wangenh.) K. Koch – Frequent; T, S, R; 441. *Carya glabra* (Mill.) Sweet – Occasional; S, R; 466. *Carya ovata* (Mill.) K. Koch – Abundant; T, S, R, P; 430. *Carya tomentosa* (Poir.) Nutt. – Rare; P; 478. PT *Juglans cinerea* L. – Rare; S; 658. *Juglans nigra* L. – Occasional; S; 679.

JUNCACEAE. *Juncus effusus* L. – Infrequent; P; 128. *Juncus tenuis* Willd. – Infrequent; S, R; 106. *Luzula echinata* (Small) F. J. Herm. – Occasional; T, S; 512.

LAMIACEAE. *Agastache nepetoides* (L.) Kuntze – Rare; Path; 311. *Blephilia hirsuta* (Pursh) Benth. – Rare; T; 271. *Clinopodium vulgare* L. – Rare; P; 698. *Collinsonia canadensis* L. – Infrequent; T, S; 415. *Cunila origanoides* (L.) Britton – Frequent; S, R; 321. **Glechoma hederacea* L. – Infrequent; Path; 610. *Hedeoma pulegioides* (L.) Pers. – Infrequent; S; 306. **Lamium purpureum* L. – Infrequent; S; 8. *Lycopus virginicus* L. – Infrequent; S; 427. *Monarda fistulosa* L. – Rare; E; 659. *Prunella vulgaris* L. – Occasional; S, P; 201. *Pycnanthemum tenuifolium* Schrad. – Rare; P; 199. *Salvia lyrata* L. – Rare; S; 605. *Scutellaria lateriflora* L. – Rare; E; 400. *Scutellaria nervosa* Pursh – Infrequent; T; 604. *Scutellaria ovata* Hill – Rare; S; 702. *Scutellaria serrata* Andrews – Occasional; T, S; 600. *Teucrium canadense* L. – Rare; Path; 653.

LAURACEAE. *Lindera benzoin* (L.) Blume – Abundant; T, S, R, P; 509. *Sassafras albidum* (Nutt.) Nees – Frequent; T, S, R, P; 472.

LILIACEAE. *Allium tricoccum* Aiton – Occasional; T, S; 226. **Allium vineale* L. – Infrequent; T; 56. ***Chamaelirium luteum* (L.) A. Gray – Rare; S; no voucher. *Erythronium albidum* Nutt. – Rare; S; 510. *Erythronium americanum* Ker Gawl. – Occasional; T, S; 519. *Polygonatum biflorum* (Walter) Elliott – Occasional; T, S, R; 601. *Smilacina racemosa* (L.) Desf. – Frequent; T, S, R, P; 560. *Trillium grandiflorum* (Michx.) Salisb. – Occasional; T, S; 14. *Trillium sessile* L. – Rare; T; 30. *Uvularia grandiflora* Sm. – Occasional; T, S; 552.

LIMNANTHACEAE. *Floerkea proserpinacoides* Willd. – Infrequent; T; 543.

MAGNOLIACEAE. *Liriodendron tulipifera* L. – Abundant; T, S, R, P; 42. *Magnolia acuminata* (L.) L. – Rare; T; 654.

MENISPERMACEAE. *Menispermum canadense* L. – Occasional; T, S; 640.

MONOTROPACEAE. *Monotropa uniflora* L. – Infrequent; T, S, R; 180.

MORACEAE. **Maclura pomifera* (Raf.) C. K. Schneid. – Rare; P; 256. *Morus rubra* L. – Rare; S; 617.

OLEACEAE. *Fraxinus americana* L. – Occasional; T, S; 460. *Fraxinus pennsylvanica* Marshall – Occasional; T, S, R, P; 392. *Fraxinus quadrangulata* Michx. – Occasional; T, S, R; 239.

ONAGRACEAE. *Circaea lutetiana* L. – Occasional; T, S, R, P; 158. *Epilobium coloratum* Biehler – Rare; E; 424. *Ludwigia alternifolia* L. – Rare; E; 688.

ORCHIDACEAE. *Aplectrum hyemale* (Muhl. ex Willd.) Torr. – Infrequent; T, S; 609. *Corallorhiza odontorhiza* (Willd.) Poir. – Infrequent; T, S; 349. PT *Corallorhiza wisteriana* Conrad – Rare; R; 571. ***Cypripedium parviflorum* Salisb. – Rare; T; no

voucher. *Goodyera pubescens* (Willd.) R. Br. ex W. T. Aiton – Infrequent; T, S; 408. *Spiranthes vernalis* Engelm. & A. Gray – Rare; S; 465.

OROBANCHACEAE. *Conopholis americana* (L.) Wallr. – Occasional; T, S, R; 597. *Epifagus virginiana* (L.) Barton – Frequent; T, S; 346.

OXALIDACEAE. *Oxalis dillenii* Jacq. – Occasional; T, S, R; 35. *Oxalis violacea* L. – Infrequent; S, R; 39.

PAPAVERACEAE. *Sanguinaria canadensis* L. – Occasional; T, S; 504.

PASSIFLORACEAE. *Passiflora lutea* L. – Rare; S; 674.

†PHRYMACEAE. *Phryma leptostachya* L. – Occasional; T, S; 186.

PHYTOLACCACEAE. *Phytolacca americana* L. – Occasional; S; 285.

PLANTAGINACEAE. **Plantago lanceolata* L. – Infrequent; Path; 681. *Plantago rugelii* Decne. – Infrequent; Path; 301.

PLATANACEAE. *Platanus occidentalis* L. – Infrequent; T, S, R; 626.

POACEAE. *Agrostis perennans* (Walter) Tuck. – Occasional; S, R, P; 330. *Andropogon virginicus* L. – Infrequent; P; 476. *Brachyelytrum erectum* (Schreb. ex Spreng.) P. Beauv. – Occasional; T, S, R; 176. *Bromus pubescens* Muhl. ex Willd. – Occasional; S, R; 47. *Cinna arundinacea* L. – Infrequent; Path; 303. **Dactylis glomerata* L. – Infrequent; P; 140. *Danthonia spicata* (L.) P. Beauv. ex Roem. & Schult. – Occasional; S, R, P; 49. *Diarrhena americana* P. Beauv. – Occasional; S, R, P; 112. *Echinochloa muricata* (P. Beauv.) Fernald – Rare; S; 388. *Elymus hystrix* L. – Occasional; T, S, R, P; 114. *Elymus villosus* Muhl. ex Willd. – Occasional; T, S, R; 182. *Festuca subverticillata* (Pers.) E. B. Alexeev – Infrequent; T; 94. *Glyceria striata* (Lam.) Hitchc. – Infrequent; T, R; 148. **Holcus lanatus* L. – Rare; E; 685. *Leersia virginica* Willd. – Infrequent; T; 278. *Panicum acuminatum* Sw. – Infrequent; S, R, P; 124. *Panicum boscii* Poir. – Occasional; S, R, P; 324. *Panicum clandestinum* L. – Infrequent; S, R; 630. *Panicum dichotomum* L. – Infrequent; R; 372. **Phleum pratense* L. – Infrequent; E; 216. **Poa compressa* L. – Occasional; S, R; 50. *Poa cuspidata* Nutt. – Occasional; T, S, R; 511. *Poa sylvestris* A. Gray – Occasional; T; 606. *Tridens flavus* (L.) Hitchc. – Rare; P; 253.

POLEMONIACEAE. *Phlox divaricata* L. – Occasional; T, S, R; 1. *Polemonium reptans* L. – Occasional; T, S, R; 15.

POLYGALACEAE. *Polygala sanguinea* L. – Rare; P; 218. *Polygala verticillata* L. – Rare; Path; 307.

POLYGONACEAE. **Polygonum caespitosum* Blume – Occasional; T, S, R, P; 168. *Polygonum punctatum* Elliott – Occasional; T, S; 228. *Polygonum sagittatum* L. – Rare; T, S; 338. *Polygonum scandens* L. – Rare; E; 378. *Polygonum virginianum* L. – Occasional; T, S, R, P; 260. **Rumex* sp. – Rare; S; 647.

PORTULACACEAE. *Claytonia virginica* L. – Frequent; T, S, R; 6.

PRIMULACEAE. *Lysimachia ciliata* L. – Rare; T; 270.

PYROLACEAE. *Chimaphila maculata* (L.) Pursh – Occasional; R; 166.

RANUNCULACEAE. *Actaea pachypoda* Elliott – Occasional; T, S; 258. *Anemone virginiana* L. – Occasional; S; 296. *Cimicifuga racemosa* (L.) Nutt. – Frequent; T, S, R; 178. *Delphinium tricorne* Michx. – Occasional; T, S, R; 20. *Hepatica acutiloba* DC. – Frequent; T, S; 503. *Hydrastis canadensis* L. – Occasional; T, S, R; 541. *Ranunculus abortivus* L. – Occasional; S; 3. *Ranunculus micranthus* Nutt. – Occasional; S; 558. *Thalictrum dioicum* L. – Infrequent; T, S; 554. *Thalictrum thalictroides* (L.) A. J. Eames & B. Boivin – Occasional; T, S, R; 22.

ROSACEAE. *Agrimonia parviflora* Aiton – Infrequent; R, P; 402. *Agrimonia pubescens* Wallr. – Occasional; T, S, R; 197. *Amelanchier arborea* (F. Michx.) Fernald – Occasional; S, R; 242. *Crataegus pruinosa* (H. L. Wendl.) K. Koch – Infrequent; R; 370. *Crataegus* sp. – Infrequent; S; 424. *Geum canadense* Jacq. – Frequent; T, S, R; 164. *Geum vernum* (Raf.) Torr. & A. Gray – Occasional; T, S, R; 12. *Malus coronaria* (L.) Mill. – Rare; E; 33. *Porteranthus stipulatus* (Muhl. ex Willd.) Britton – Occasional; S, R; 188. *Potentilla simplex* Michx. – Occasional; T, S, R; 44. *Prunus serotina* Ehrh. – Occasional; T, S; 686. *Rosa carolina* L. – Infrequent; R, P; 105. **Rosa multiflora* Thunb. ex Murray – Frequent; T, S, R, P; 593. *Rosa setigera* Michx. – Rare; E; 627. *Rubus allegheniensis* Porter – Frequent; T, S, R, P; 591. *Rubus flagellaris* Willd. – Occasional; S, R; 43. *Rubus occidentalis* L. – Occasional; T, S, R, P; 608. *Spiraea tomentosa* L. – Infrequent; S, R; 231.

RUBIACEAE. *Galium aparine* L. – Occasional; T, S, R; 9. *Galium circaezans* Michx. – Occasional; T, S, R; 45. *Galium concinnum* Torr. & A. Gray – Frequent; T, S, R; 154. *Galium pilosum* Aiton – Infrequent; S, P; 203. *Galium triflorum* Michx. – Frequent; T, S, R; 174. *Houstonia caerulea* L. – Infrequent; S; 24. *Houstonia longifolia* Gaertn. – Occasional; S, R, P; 116. *Mitchella repens* L. – Rare; T; 652.

SALICACEAE. *Populus grandidentata* Michx. – Occasional; T, S, R; 334. *Salix nigra* Marshall – Infrequent; E; 26.

SAXIFRAGACEAE. *Heuchera americana* L. – Infrequent; T, S; 594. *Saxifraga virginiana* Michx. – Occasional; T, S, R; 28.

SCROPHULARIACEAE. *Mimulus alatus* Aiton – Rare; S; 695. *Penstemon digitalis* Nutt. ex Sims – Infrequent; S, R; 57.

SIMAROUBACEAE. **Ailanthus altissima* (Mill.) Swingle – Rare; E; 675.

SMILACACEAE. *Smilax glauca* Walter – Rare; S, R, P; 613. *Smilax hispida* Muhl. ex Torr. – Infrequent; T, S; 611. *Smilax rotundifolia* L. – Frequent; T, S, R, P; 318.

SOLANACEAE. *Solanum carolinense* L. – Infrequent; S, P; 211. *Solanum nigrum* L. – Rare; S; 419.

STAPHYLEACEAE. *Staphylea trifolia* L. – Occasional; T; 417.

TILIACEAE. *Tilia americana* L. – Occasional; T, S, R; 639.

ULMACEAE. *Celtis occidentalis* L. – Occasional; T, S, R; 422. *Ulmus americana* L. – Occasional; T, S, R, P; 445. *Ulmus rubra* Muhl. – Occasional; T, S; 444.

URTICACEAE. *Boehmeria cylindrica* (L.) Sw. – Occasional; T; 261. *Laportea canadensis* (L.) Wedd. – Frequent; T; 257. *Pilea pumila* (L.) A. Gray – Frequent; T, S; 352.

VALERIANACEAE. *Valerianella chenopodiifolia* (Pursh) DC. – Rare; S; 559.

VERBENACEAE. *Verbena urticifolia* L. – Infrequent; S, P; 287.

VIOLACEAE. *Viola canadensis* L. – Frequent; T, S; 10. *Viola pubescens* Aiton – Occasional; T, S; 2. *Viola sororia* Willd. – Occasional; T, S, R; 13. *Viola striata* Aiton – Frequent; T, S; 29.

VITACEAE. *Parthenocissus quinquefolia* (L.) Planch. – Frequent; T, S, R, P; 643. *Vitis aestivalis* Michx. – Infrequent; T, R, P; 97. *Vitis vulpina* L. – Occasional; S, R; 55.